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FUSIBLE INTERLINING

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ABSTRACT OF THE DISCLOSURE

Fabric fusible interlining with terpolymeric resin as thermoplastic adhesive, characterized in that 100% of the said terpolymer consists of 3–30% by weight styrene, 20–50% by weight acrylonitrile, and 20–77% by weight alkylacrylate having C₁–C₄ alkyl radical, and the terpolymer has an intrinsic viscosity in the range between 0.3 and 0.7 dl./g. (determined in dimethylformamide at 30° C.) and melts in the range of 60–150° C.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to new type fusible interlining, which can be bonded easily to fabrics during manufacturing process of garments which interlining never peels off during washing or drycleaning.

Discussion of prior art

In recent years, various kinds of fusible interlining containing thermoplastic adhesives in powder, fibrous or film form on base fabrics or repellent paper, have been developed. These have been employed by garment manufacturers for the purposes of improving their manufacturing processes and producing fine-finished garments by bonding with pre-cut outer fabrics or linings instead of stitching them together. However, in most cases of the above conventional interlinings, polyethylenes have been employed as the fusible agent, and these interlinings have been used only for pre-cut small areas of the garment such as at the collars, cuffs, hems, etc., for "temporary bonding," since they inflict a hard touch on outer fabrics or linings after bonding. Furthermore, their bonding strength and resistances, e.g., resistance for washing, drycleaning, etc., are not sufficient for many purposes.

Therefore, it has become desirable to provide new fusible interlinings for "whole front bonding" which can be used at large pre-cut parts of the garment such as front parts of suits, jackets, coats, etc., without any fear of degrading the finished garment. That is, garment manufacturers desire to improve their working processes by bonding interlinings and pre-cut outer fabrics together by use of a conveyor system in which a rotative heat pressing machine is employed, thereby eliminating or curtailing stitching processes such as interlining-basting, etc. However, in order to realize "whole front bonding," excellent fusible agents having sufficient bonding strength and resistances for washing and drycleaning, are needed. In these essential properties, thermoplastic adhesives employed in conventional fusible interlinings are unsatisfactory.

That is, polyethylene adhesives have disadvantages in bonding strength and resistance for drycleaning. Polyamide adhesives are fairly satisfactory in bonding strength and resistance for drycleaning, but they are not sufficient in resistance for washing and required steaming for any appreciably long period of time to obtain fusion. Further-

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more, if they contain plasticizer, they suffer from disadvantages causing problems such as deterioration owing to the transition of plasticizer at storage, generation of stickiness resulting from softening of said adhesives, and so on. Polyvinyl acetate adhesives sometimes cause "peel off" at relatively high temperature in comparison with other adhesives.

In view of the above-mentioned situation, various examinations have been conducted to develop excellent fusible interlinings for whole front bonding, which have sufficient bonding strength and resistances, especially for washing and drycleaning. It has now been found that terpolymeric resins comprising styrene, acrylonitrile and alkylacrylate possess pre-eminent bonding strength and resistances, especially well-balanced resistance for washing and drycleaning.

While styrene-acrylonitrile-alkylacrylate terpolymer has been proposed as an aid in improving dyeing of acrylonitrile synthetic fibers, it has not been proposed as a thermoplastic adhesive for fusible interlinings.

SUMMARY OF THE INVENTION

This invention relates to a fusible interlining containing as an adhesive terpolymeric resin characterized in that 100% of the said terpolymer consists of 3–30% by weight of styrene, 20–50% by weight of acrylonitrile and 20–77% by weight of alkylacrylate having C₁–C₄ alkyl radical, said terpolymer having an intrinsic viscosity in the range of 0.3–0.7 (determined in dimethylformamide at 30° C.) and a melting point range of 60–150° C. Said terpolymeric resin is suitably employed on said interlining in powder, fibrous or film state, or is used as interlining by itself without any base sheet. The interlining can be in the form of a fabric or repellent paper.

DESCRIPTION OF SPECIFIC EMBODIMENTS

The composition and advantages of this invention are described as follows:

Terpolymer of styrene-acrylonitrile-alkylacrylate, applied to the invention, is obtained by polymerizing styrene, acrylonitrile and alkylacrylate (i.e. methylacrylate, ethyl acrylate, propylacrylate or butylacrylate) according to the common polymerization processes such as emulsion, polymerization, suspension polymerization, solution polymerization, or the like. For example, aqueous or organic suspensions of styrene, acrylonitrile, alkylacrylate, catalyst and, if necessary, polymerization regulator and emulsifier, are charged in a reaction kettle equipped with stirrer, reflux condenser and thermometer, and are polymerized in nitrogen gas at required temperature and for desired periods of time. The resulting terpolymer of styrene-acrylonitrile-alkylacrylate is separated by a "salting out method" or "solvent precipitation method," washed by water, alcohol or petroleum benzene, and dried. Then, white or light-yellowish, solid terpolymer of styrene-acrylonitrile-alkylacrylate is obtained.

Alkylacrylate, an ingredient of said terpolymer, suitably has a C₁–C₄ alkyl radical, and is a compound such as methylacrylate, ethylacrylate, propylacrylate, or butylacrylate. Of these, ethylacrylate is the most suitable from the viewpoints of ease in processing, bonding strength, resistances, etc. for the derived terpolymer.

As catalyst, persulfates, peroxides such as hydrogen peroxide, organic peroxides such as benzoyl peroxide or cumenhydroperoxide, redox catalysts by combining the above peroxides and reducing agent, are applicable.

As polymerization regulator, well-known polymerization regulators—alkyl mercaptans such as lauryl mercaptan, alkyl amines such as diethyl amine, alkanol amines such as monoethanol amine, chlorinated hydrocarbons such as carbon tetrachloride, trichloroethylene, etc. can be used singly or jointly.

As emulsifying agent, well-known surfactants can be used, but especially it is desirable that an anionic agent such as lauryl sodium sulfide, or non-ionic agent such as polyethylene glycol alkylphenol ether, be applied singly or jointly. Furthermore, these agents, when used in quantities, exert effective actions not only on emulsification but also on polymerization regulation so they are most suitable for making terpolymers employed pursuant to this invention.

Also, acrylamides and their derivatives, vinyl acetate, methacrylonitrile, vinyl toluene, divinyl benzene, acrylic acid, glycyzyl methacrylate, alkyl methacrylate, other alkyl acrylates, etc. are employed as co-monomers that can be polymerized with styrene, acrylonitrile and alkylacrylate. One or more of the above-mentioned co-polymers can be polymerized subsidiarily in some cases.

All that need be conducted for obtaining styrene-acrylonitrile-alkylacrylate terpolymer as in the invention is to select well-known conditions for polymerization reaction such as respective concentrations of said three monomers, methods of addition, kinds and amounts of catalyst, solvent, polymerizing regulator, emulsifying agent, etc. stirring speed at reaction, temperature, and so on.

As mentioned above, terpolymers of styrene-acrylonitrile-alkylacrylate, which consist of 3-30% by weight styrene, 20-50% by weight acrylonitrile and 20-77% by weight alkylacrylate having C_1-C_4 alkyl radical, and have intrinsic viscosity in the range between 0.3 and 0.7 (determined in dimethylformamide at 30° C.) and melt in the range of 60-150° C. can be obtained. These terpolymers fulfill all the following conditions requisite to thermoplastic adhesive for fusible interlining.

(1) They fuse at temperatures at which outer fabrics, linings and base sheets are not damaged or deteriorated, and have sufficient bonding strength after bonded with fabrics.

(2) They have proper viscosity at fusion and do not cause problems such as "strike-through" as in the case of low viscosity adhesives, "declination of bonding strength" resulting from ill-adaptation to fabrics as in the case of higher viscosity adhesives.

(3) They possess suitable properties for processings such as powdering, crushing, film-forming, spinning, etc.

(4) They possess resistant properties for water, heat, alkali, and solvent, all of which are indispensable for interlinings.

(5) They do not impair the touch of the fabric.

(6) They do not have a limited "shelf life" as in thermosetting resins.

(7) They do not necessitate addition of migratory additives such as plasticizers.

(8) They can be manufactured at low cost.

As stated above the composition percentages of styrene, acrylonitrile, and alkylacrylate in said terpolymers of this invention fall within the limits of 3-30% by weight of styrene, 20-50% by weight of acrylonitrile and 20-77% by weight of alkylacrylate. These ranges are set forth because if the styrene content is below 3% by weight, the resulting terpolymer is inferior in resistance to water and alkali, and an interlining with said terpolymeric adhesive suffers from a disadvantage in resistance for washing. If the styrene content is over 30% by weight, the terpolymers are not resistant to solvents and this means that interlinings with such terpolymeric resin suffer from a disadvantage in resistance during drycleaning.

In cases where the acrylonitrile content is below 20% by weight, or alkylacrylate content is over 77% by weight, the resulting terpolymers are poorly water, alkali and solvent resistant and interlinings carrying these terpolymers as fusible agent have disadvantages in resistances after bonding, especially resistances for washing and drycleaning. Moreover, in cases where acrylonitrile content is over 50% by weight, or alkylacrylate content is below 20% by weight, the terpolymers have a disadvantage in respect of the melting point range which is as high as 150° C.

Accordingly, interlinings with these terpolymers as fusible agents are not suitable for bonding with fabrics, and if said interlinings are bonded at high temperature, some types of outer fabrics or linings will be damaged or deteriorated during processing.

The intrinsic viscosity of styrene-acrylonitrile-alkylacrylate terpolymers in this invention is 0.3-0.7 (dl./g.) in dimethylformamide at 30° C. In case terpolymers whose intrinsic viscosity is below 0.3 are applied as thermoplastic adhesives, the interlinings are poor in bonding strength and sometimes may cause fabrics to spoil or impair the touch of the fabric itself since these terpolymers are apt to strike into the fabrics during bonding, due to their own low intrinsic viscosity. On the contrary, in the event a terpolymer having an intrinsic viscosity over 0.7 is applied as fusible agent, the resultant interlining is insufficient in bonding strength as well, since the terpolymer does not strike into fabric at all, due to its high intrinsic viscosity. If one attempts to bond the interlining to a fabric, the fabric to be bonded may be damaged or deteriorated.

Further, the melting temperature of styrene-acrylonitrile-alkylacrylate terpolymers employed pursuant to the invention are in the range of 60-150° C. and the melting temperature of said terpolymers, necessitated for bonding the interlinings carrying said terpolymers as fusible agent, is 150° C. at the highest. In case the melting temperature is over 150° C., the terpolymers are not suitable for interlining, since they must be given such severe conditions for bonding as may damage or deteriorate fabrics.

On the contrary, if the terpolymer has a melting point below 60° C., it softens too readily with rising temperature and consequently the bonding strength becomes lower. This means that the bonding strength of interlinings containing such readily melted terpolymer as fusible agent becomes worse when they are washed or drycleaned at high temperature. Melting temperature, described here, means the temperature, at which polymers become soft by heating and their viscosity begins to drop rapidly. Generally, it is determined by the temperature, at which polymers become soft by heating under constant pressure and then begin to flow. More, melting temperature can be also determined by the temperature, at which polymers begin to melt, using a constant pressure extruding flow tester, e.g. KOKA Flow Tester (a tester, developed by Kobunshi Kagaku Kenkyusho and made by Shimazu Seisakusho), that is, by the temperature at which the plunger starts to drop by the flow of melted polymers into the nozzle.

Interlinings with said terpolymers as fusible agent provide their own advantages fully, when they are heat-pressed at the above-mentioned desirable temperature or at a little higher temperature, but thereby not damaging nor deteriorating fabrics.

Said terpolymers are used as thermoplastic adhesives in states of powder, fiber or film.

The manufacturing methods of fusible interlinings with styrene-acrylonitrile-alkylacrylate terpolymers in each state as thermoplastic adhesive are exemplified as follows:

(1) Fixing terpolymer powders obtained by grinding or solution precipitation on the surface of nonwoven or woven fabric by sprinkling and thereafter fusing the so sprinkled terpolymer adhesive to the interlining fabric.

(2) Fixing dissolved or molten terpolymer on the surface of nonwoven or woven fabric by spraying in the form of dots or in the form of a web (like a spider's web) from the nozzle and by drying thereafter as by cooling the molten polymer;

(3) Fixing the terpolymer solution, dispersion or powder on the surface of nonwoven or woven fabric by printing into a dotted or checked pattern;

(4) Producing web-formed interlining by spraying or spinning said dissolved or molten terpolymer on the surface of repellent paper such as in the form of a spider's

web from a nozzle and removing solvent or cooling to solidify the polymer; and

(5) Producing interlining by laminating film obtained from terpolymer with repellent paper or nonwoven or woven fabric.

Interlinings for bonding purposes obtained from the foregoing methods provide the following advantages:

(a) Fusible interlinings of this invention provide excellent bonded products having eminent bonding strength without impairing the touch of fabric to be bonded.

(b) Bonded products of interlinings in this invention and fabrics have excellent resistances for washing and drycleaning, needless to say durability as garments.

(c) Interlinings of this invention facilitate the temperature control of pressing machines, since they can be bonded in wide range of pressing temperature (e.g. 100–180° C.) and more the bonded products have excellent bonding strength.

(d) Styrene-acrylonitrile-alkylacrylate terpolymers, applied as heat-sensitive adhesives of this invention, can provide interlinings fusible at fairly low temperature, since their bonding strength and resistances are excellent even if the terpolymers melting at relatively low temperatures such as 60–100° C. are employed as fusible agent for interlinings.

(e) Heat-sensitive adhesives comprising the terpolymers possess suitable properties for processings, so that various kinds of interlinings can be provided in accordance with this invention.

(f) Styrene-acrylonitrile-alkylacrylate, terpolymers, applied as heat-sensitive adhesives of this invention, are effective for interlinings even if plasticizer is not used jointly, so there is no fear of causing deterioration at storage or use, resulting from the transition of plasticizer.

(g) Styrene-acrylonitrile-alkylacrylate terpolymers, applied as heat-sensitive adhesives of this invention, do not have limited "shelf life" (storage life), since they are thermoplastic resins. Accordingly, interlining carrying said terpolymers as fusible agent possess excellent stabilization at storage.

(h) Styrene-acrylonitrile-alkylacrylate terpolymers, applied as heat-sensitive adhesives of this invention, are excellent in stability to heat, so interlinings comprising said terpolymers do not bring about "coloring" or "decomposition" during bonding to fabrics. Accordingly, there is no fear of spoiling or damaging fabrics.

(i) Fusible interlinings of this invention make it possible to improve manufacturing processes of garments by bonding the same with pre-cut outer fabrics or linings instead of stitching the same together. That is, they contribute greatly to "labor-savings" of hand-working processes, without lowering the quality of finished garments.

(j) Fusible interlinings of this invention are very useful as interlinings for making shoes and in other fields as well as for manufacturing garments.

(k) Fusible interlinings of this invention show eminent bonding strength and more have excellent resistances even if they are bonded at low temperature in the event steaming is conducted during bonding with fabric. Therefore, they are especially useful for bonding with fabrics susceptible to heat-discoloring or heat-shrinkage.

(l) Styrene-acrylonitrile-alkylacrylate terpolymers, applied as heat-sensitive adhesives of this invention, can be produced at low cost without using special reaction kettles such as high pressure kettles.

(m) The regulation of the composition, intrinsic viscosity and melting temperature of styrene-acrylonitrile-alkylacrylate terpolymer, applied as heat-sensitive adhesive pursuant to the invention, can be adjusted not only by changing the conditions of polymerization but also by blending more than two kinds of the above polymers. Besides, the mixtures of said terpolymers are effective also in respect of quality control, since they have properties equal to a single terpolymer.

The amount of fusible interlining disposed on the surface of the woven or nonwoven fabric will depend upon the nature of such fabric, its weight and the particular use for which the interlining is to be employed. Various sections of a garment may require different amounts of adhesive on the interlining to provide the desired stiffening or supporting function. Generally speaking, there will be between 15 and 45 grams of terpolymer per square meter of interlining fabric.

Hence, this invention provides more eminent and superior effects in comparison to conventional heat-sensitive adhesives. Hence, the above specifically described terpolymers are suited for industrial use.

In order to more fully illustrate the invention and the manner of practicing the same, the following examples are presented:

EXAMPLE 1

15 parts by weight of styrene, 38 parts by weight acrylonitrile, 47 parts by weight ethyl acrylate, 2 parts by weight potassium persulfate, 2 parts by weight sodium bisulfite, 9 parts by weight lauryl mercaptan, 8 parts by weight lauryl sodium sulfate and 500 parts by weight distilled water were charged in a reaction kettle equipped with stirrer, reflux condenser and thermometer, and heated at 65° C. in nitrogen gas in order to initiate a polymerization reaction. Then, the temperature was raised to 70–75° C. and the reaction was conducted for 90 minutes.

After the reaction was completed, the reaction product was poured into methanol to precipitate styrene-acrylonitrile-ethylacrylate terpolymer. Further, the precipitate was washed repeatedly by water and methanol, and refined. Then, said terpolymer was dried at the temperature of 50° C. In the above method, a terpolymer, which is composed of 12.5 by weight styrene, 34.8% by weight acrylonitrile and 52.7% by weight ethylacrylate, and which had an intrinsic viscosity of 0.460 (in dimethylformamide at 30° C.), became soft at 73° C. and melted at 122° C., was obtained. (Yield: 95%.)

This terpolymer was finely divided with a powdering machine. The powders were passed through a Tyler mesh sieve. Then, 25 g./m.² of the powders were sprinkled on the surface of a nylon fiber non-woven fabric and fixed by fusion. A fusible interlining was produced. When this interlining was bonded with an outer fabric (tropical, blended wovens of wool 55% and polyester 45%) under the bonding conditions (temperature: 120° C., steaming: 5 seconds, pressing: 5 seconds), the bonded product showed eminent properties as in Table 1.

Furthermore, as shown in Table 2, the temperature of heat-pressing (by pressing machine) can be applied within wide temperature range, and excellent bonding strength was shown within the temperature range of 100–180° C.

Respective contents of styrene, acrylonitrile and ethylacrylate in said terpolymer can be determined by "combustion method" using an elementary analyzer.

The intrinsic viscosity in dimethylformamide at 30° C. was determined with Ubbelohde viscometer from five solutions having different concentration obtained by dissolving 0.1–3 g. of said terpolymer in 100 ml. of the solvent.

Softening point and melting point were determined by a constant pressure extruding flow tester under the conditions of nozzle diameter: 0.5 mm., nozzle length: 1 mm., plunger section size: 1 cm.², pressure: 10 kg./cm.², temperature rising speed: 6° C./min. That is, in the relations between temperature and plunger drop amount, softening point was indicated by the temperature, at which plunger drop amount started standing at a constant value according to the rise of temperature, and melting point was indicated by the temperature, at which plunger drop amount started increasing due to the flow of melted resins to the nozzle.

of styrene, 35.3% by weight acrylonitrile and 48.5% by weight ethylacrylate, in average content, and had the intrinsic viscosity of 0.410 (in dimethylformamide at 30° C.), became soft at 77° C. and melted at 110° C. By the same method as in Example 1, powders which passed through 50 Tyler mesh were obtained. 25 g./m.² of said powder was sprinkled onto the surface of nylon fiber non-woven fabric and fixed thereon by heating. A fusible interlining was produced. When this interlining was bonded with an outer fabric (tropical, blended wovens of wool 55% and polyester 45%) under the bonding conditions (temperature: 120° C., steaming: 5 seconds, pressing: 5 seconds), the bonded product showed eminent properties as in Table 1. Furthermore, as shown in Table 2, it was proved that wide temperature range can be utilized for bonding.

Also, when interlinings obtained respectively from Examples 1 through 6 were bonded with said outer fabric by using "dry pressing method" under the conditions (temperature: 140° C., pressing: 5 seconds), the bonded products showed nearly the same values as those by "wet pressing method" (temperature: 120° C., steaming: 5 seconds, pressing: 5 seconds), as shown in Table 1.

EXAMPLE 7

Styrene-acrylonitrile-ethylacrylate terpolymer, obtained in Example 1, was melted into liquid state by heating, and the molten terpolymer was spun out on the surface of a silicone-coated repellent paper from a nozzle by the help of an air jet at 20° C. Thus, a fusible interlining, comprising repellent paper and entangled fiber layer applied thereon, was produced. When this fusible fleece was inserted between and bonded to two sheets of outer fabrics (tropical, blended wovens of wool 55% and polyester 45%), the bonded product showed eminent properties equivalent to those produced pursuant to Example 1.

EXAMPLE 8

Styrene-acrylonitrile-ethylacrylate terpolymer, obtained in Example 1, was dissolved in dimethylformamide to make 3% solution of it. This solution was spread on a fluoride resin coated repellent plate to the thickness of 1 mm. with a doctor knife. Thereafter, the plate was introduced in water at 50° C. to coagulate the solution and obtain polymer film of 0.05 mm. thickness.

The film was laid on nylon fiber non-woven fabric and heated at 130° C. to produce a fusible interlining with styrene-acrylonitrile-ethylacrylate terpolymer film laminated thereon. When this interlining was bonded with an outer fabric (tropical, blended wovens of wool 55% and polyester 45%), in the bonded product showed excellent properties equivalent to those of Example 1.

For purposes of comparison several samples from different terpolymers of styrene-acrylonitrile-alkylacrylate from that of this invention were applied as thermoplastic adhesives. Their properties are shown in Table 1.

Reference 1

5 parts by weight styrene, 47.5 parts by weight acrylonitrile, 47.5 parts by weight ethylacrylate, 2 parts by weight potassium persulfate, 2 parts by weight sodium bisulfite, 0.5 parts by weight lauryl mercaptan, 2 parts by weight of lauryl sodium sulfate and 500 parts by weight distilled water were charged in the same reaction kettle as in Example 1 and were heated at 65° C. in nitrogen gas in order to initiate the polymerization reaction. After 5 minutes of reaction start, the temperature was raised to 75° C. and the reaction was conducted for 90 minutes. After the reaction was completed, the reaction product was separated by precipitation, refined and dried, as in Example 1. A terpolymer, comprising 2.1% by weight styrene, 51.4% by weight acrylonitrile and 46.5% by

weight ethylacrylate, and which had the intrinsic viscosity of 0.712 (in dimethylformamide at 30° C.), became soft at 90° C. and melted at 158° C., was obtained. By dividing this terpolymer by the same method as in Example 1, powders which passed through 50 Tyler mesh were obtained. 25 g./m.² of the powder was sprinkled onto the surface of nylon fiber nonwoven fabric and fixed thereon by heating at the same temperature as in Examples 1 through 6. A fusible interlining was produced. When this interlining was bonded to an outer fabric (tropical mixture of wool 55% and polyester 45%), the bonded product was inferior in bonding strength and resistance to those produced by Examples 1-6, as shown in Table 1, and did not show any remarkable advantage in comparison to the bonded results of conventional interlinings.

Reference 2

By the same method as Reference 1, a terpolymer composed of 10.3% by weight of styrene, 8.2% by weight acrylonitrile and 81.5% by weight ethylacrylate, having the intrinsic viscosity of 0.375 (in dimethylformamide at 30° C.), became soft at 59° C. and melted at 90° C., was obtained. By dividing this terpolymer by the same method as in Example 1, powders which passed through 50 Tyler mesh were obtained. 25 g./m.² of the powders were sprinkled onto the surface of nylon fiber nonwoven fabric and fixed thereon by heating. A fusible interlining was produced. When this interlining was bonded with an outer fabric (tropical, blended wovens of wool 55% and polyester 45%), the bonded product showed equivalent advantage to the cases of Examples 1-5 in respect of bonding strength, but it was not suitable for practical use, due to its insufficient resistance in comparison with the interlinings of Examples 1-6, as shown in Table 1.

Reference 3

By the same method as Reference 1, a terpolymer composed of 31.4% by weight styrene, 35.2% by weight acrylonitrile and 33.4% by weight ethylacrylate, and which had an intrinsic viscosity of 0.394 (in dimethylformamide at 30° C.), became soft at 84° C. and melted at 148° C., was obtained. By dividing this terpolymer by the same method as in Example 1, powders which passed through 50 Tyler mesh were obtained. 25 g./m.² of the powders were sprinkled onto the surface of nylon fiber non-woven fabric and fixed thereon by heating. A fusible interlining was produced. When this interlining was bonded with an outer fabric (tropical, blended wovens of wool 55% and polyester 45%), the bonded product was not suitable for practical use, since its bonding strength and resistances were inferior to the interlinings of Examples 1-6, as shown in Table 1.

Reference 4

By the same method as Reference 1, a terpolymer, which is composed of 2.4 parts by weight styrene, 10.2 parts by weight acrylonitrile and 80.5 parts by weight butylacrylate, and which had an intrinsic viscosity of 0.284 (in dimethylformamide at 30° C.), became soft at 48° C. and melted at 58° C., was obtained. The obtained terpolymer was formed into film state by the same method as described in Example 8 and was laid on the surface of nylon fiber non-woven fabric to produce a laminant fusible interlining. When this interlining was bonded with an outer fabric (tropical, blended wovens of wool 55% and polyester 45%), the bonded product was not suitable for practical use, since its bonding strength and resistances were insufficient in comparison with the interlining of Example 8.

The following Table 1 shows the comparison test data in bonding strength and resistances among examples of this invention, reference examples and conventional inter-

linings for bonding purpose. Table 2 shows the comparison data concerning relations between heat-pressing temperature and bonding strength in the cases of conventional interlinings and examples of this invention.

TABLE 1

	Initial bonding strength (unit: kg./5 cm. wide)	Bonding strength after resistances test (unit: kg./5 cm. wide)	
		Dry-cleaning ° C.	Washing
Example:			
1-----	4.6	4.4 {	40 4.1 60 3.9
2-----	3.8	3.5 {	40 3.1 60 2.8
3-----	4.0	3.8 {	40 3.6 60 3.2
4-----	3.7	3.0 {	40 3.5 60 3.1
5-----	3.2	2.9 {	40 3.1 60 2.2
6-----	4.3	4.0 {	40 3.8 60 3.4
Reference:			
1-----	1.8	1.5 {	40 1.2 60 0.8
2-----	3.2	0.8 {	40 1.0 60 0
3-----	1.2	0.4 {	40 0.9 60 0.3
Conventional interlinings:			
a. Polyvinyl acetate powder-----	1.3	1.0 {	40 0.5 60 0
b. Polyethylene powder..	0.4	0 {	40 0.5 60 0.3
c. Polyamide power (using plasticizer)-----	1.5	1.3 {	40 1.2 60 0.8

N.B. 1

Test values of bonding strength in Table 1 were determined by the following method. Outer fabric and interlining of same size (5 cm. in width x 10 cm. in length) were laid one upon another and bonded with a testing press machine under the bonding conditions (pressure: 0.3% kg./cm.², pressing temperature: 150° C., steaming: 5 sec., pressing: 5 sec.), repellent paper was inserted between said outer fabric and interlining except the bonding part of 5 cm. wide x 4 cm. long. After that, repellent paper was removed, each unbonded edge of the outer fabric and interlining was pinched at a tension tester (Tensilon: trade name of Toyo Sokki Co.), and the bonded part was pinched at tension speed of 10 cm./min., 180° Angle Peeling Strength was tested. Values in the table are the average ones of 10 determined values per test piece.

N.B. 2

Resistance for dry-cleaning in Table 1 was determined by the following method. Bonded test pieces, obtained by the same method as N.B. 1, were given 5 35-minute dry-cleanings using 60° C. perchloroethylene with a dry-cleaning machine (automatic dry cleaner, DA Type: trade name of Hitachi Seisakusho Co.). After that, perchloroethylene was removed and bonding strength was determined by the same method as N.B. 1.

N.B. 3

Resistance for washing of 90 minutes using 40° C. aqueous solution containing neutral synthetic detergent of 0.5% by weight with an automatic electrical washing machine (whirlpooling type). The bathing ratio was 1:00. After rinsing and drying, bonding strength was determined by the same method as N.B. 1.

N.B. 4

Resistance for severe washing in Table 1 was tested by the following method. Bonded test pieces, obtained by the same method as N.B. 1, were given a severe washing of 90 minutes using 60° C. aqueous solution containing neutral synthetic detergent of 0.5% by weight with an au-

tomatic electrical washing machine (whirlpooling type). The bathing ratio was 1:00. After rinsing and drying, bonding strength was determined by the same method as N.B. 1.

TABLE 2

	Bonding strength at each pressing temperature (unit: kg./5 cm. wide)				
	100° C.	120° C.	140° C.	160° C.	180° C.
Example:					
1.....	3.7	4.0	4.4	4.2	4.0
2.....	3.2	3.6	3.8	3.8	3.4
3.....	2.8	3.1	4.0	3.9	3.6
4.....	1.8	2.2	3.1	3.6	3.7
5.....	3.7	3.8	3.2	3.0	2.5
6.....	3.0	3.4	3.9	4.4	4.4
Conventional interlinings:					
a. Polyvinyl acetate powder.....	0.8	1.3	1.8	2.2	1.7
b. Polyethylene powder.....	0.3	0.6	0.8	0.7	0.5
c. Polyamide powder.....	1.2	1.5	2.2	2.2	2.7

N.B. 5

Bonding strength values at each pressing temperature, shown in Table 2, were determined by the following method. Outer fabric and interlining were bonded at each temperature of 100° C., 120° C., 140° C., 160° C. and 180° C. by the same method and by the same machine as N.B. 1. After that, these bonded test pieces were subjected to a 180° Angle Peeling Strength Test. The values in the table are the average ones of 10 determined values per test piece.

What is claimed is:

1. In a fabric fusible interlining with terpolymeric resin as a thermoplastic adhesive, the improvement wherein 100% of the terpolymer consists of 3 to 30% by weight styrene, 20 to 40% by weight acrylonitrile, 20 to 77% by weight alkylacrylate having C₁-C₄ alkyl radical, said terpolymer having an intrinsic viscosity in the range between 0.3 and 0.7 dl./g. determined in dimethylformamide at 30° C. and melting in the range of 60 to 150° C.
2. An improvement according to claim 1 wherein the alkylacrylate is methyl acrylate.
3. An improvement according to claim 1 wherein said alkylacrylate is ethyl acrylate.
4. An improvement according to claim 1 wherein said alkylacrylate is propyl acrylate.
5. An improvement according to claim 1 wherein said alkylacrylate is butyl acrylate.
6. An improvement according to claim 1 wherein said interlining is a woven or non-woven fabric.
7. An improvement according to claim 6 wherein said fabric is made of nylon fibers.
8. An improvement according to claim 6 wherein said terpolymer is present on said fabric in the form of a powder.
9. An improvement according to claim 6 wherein said terpolymer is present on said fabric in the form of a film.
10. An improvement according to claim 6 wherein said terpolymer is in the form of randomly disposed fibers on said fabric.
11. An improvement according to claim 6 wherein said terpolymer is present on said fabric in the form of a spider's web.
12. An improvement according to claim 1 wherein said terpolymer is present on said fabric in the form of a film.
13. A method of reinforcing the fabric of a garment which comprises juxtaposing a fusible interlining of claim 1 to said garment and applying heat thereto such that the temperature is increased to between 60 and 150° C. and thereafter cooling the resultant reinforced fabric whereby the terpolymer on said interlining is caused to be melted

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and the interlining becomes fused to the fabric of said garment.

14. A reinforced garment fabric comprising a garment fabric and a fused interlining fused thereto, said interlining comprising a woven or non-woven fabric containing a terpolymer 100% of which consists of 3 to 30% by weight styrene, 20 to 50% by weight acrylonitrile, and 20 to 77% by weight of alkylacrylate having C_1-C_4 alkyl radical, said terpolymer having an intrinsic viscosity in the range between 0.3 and 0.7 dl./g. melting in the range of 60 to 150° C.

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5 MARION E. McCAMISH, Primary Examiner

U.S. Cl. X.R.

2-272; 117-28, 37, 100 A, 161 UZ; 156-327, 334,
10 161-82, 146, 148, 167, 227, 247; 260-85.5 HC, 88.1 PC

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,841,952 Dated October 15, 1974

Inventor(s) Ryuichi Kimura et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1 at the top

Inventor's name "Takuo Mortimoto" should read "Takuo Morimoto"

Column 5, line 8

"Interlinings" should be "Interlinings"

Signed and sealed this 24th day of December 1974.

(SEAL)

Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents